Patent Claims

1. A semiconductor component comprising a semiconductor body (1) and at least two electrodes (2, 3) between which are situated in the semiconductor body (1) at least one pn junction (4) and a voltage taking-up region (5) of the first conduction type, in which a space charge zone (6) propagates if a voltage that reverse-biases the pn junction (4) is applied to the electrodes (2, 3),
wherein
a temporarily effective area (9) of the first conduction type is provided in the voltage taking-up region (5), said area having, between its conduction band (L) and its valence band (V), centers (Z) which can trap free charge carriers in the event of flooding of the voltage taking-up region (5), but are discharged again in the event of propagation of the space charge zone (6), so that the area (9) is temporarily effective only in the event of a turn-off operation after flooding with free charge carriers.

2. The semiconductor component as claimed in claim 1, wherein
a zone (7) doped more highly than the voltage taking-up region (5) is provided between said voltage taking-up region (5) and the electrode (3) for said region (5), and the temporarily effective area (9) is arranged before a junction (8) with the more highly doped zone (7).

3. The semiconductor component as claimed in claim 2, wherein
the more highly doped zone (7) has the first conduction type.

4. The semiconductor component as claimed in claim 1 or 2,

wherein
the more highly doped zone (7) has the second conduction type opposite to the first conduction type.

5. The semiconductor component as claimed in one of claims 1 to 4,
wherein
the first conduction type is the n conduction type.

6. The semiconductor component as claimed in one of claims 1 to 5,
wherein
the centers (Z) are K centers.

7. The semiconductor component as claimed in claim 6,
wherein
the K centers comprise the association of a carbon atom, an oxygen atom and two vacancies (COVV).

8. The semiconductor component as claimed in claim 6 or 7,
wherein
the K centers (Z) are produced by irradiation with high-energy particles.

9. The semiconductor component as claimed in claim 8,
wherein
the K centers (Z) are additionally produced by annealing at a temperature of more than 300°C subsequent to the irradiation.

10. The semiconductor component as claimed in claim 8 or 9,
wherein
the high-energy particles are protons or helium nuclei.

11. The semiconductor component as claimed in claim 8 or 9,

wherein
the high-energy particles are carbon atoms which form K centers and contribute to the material of the semiconductor body (1).

12. The semiconductor component as claimed in one of claims 1 to 11,
wherein
the temporarily effective area (9) is a field stopping area.

13. The semiconductor component as claimed in one of claims 1 to 12,
wherein
the temporarily effective area (9) is arranged at a depth of 0.75 w_B to 0.95 w_B from the pn junction (4), where w_B denotes the distance between the pn junction (4) and the opposite edge (8) of the voltage taking-up region (5).

14. The semiconductor component as claimed in one of claims 1 to 13,
wherein
the temporarily effective area (9) has a doping concentration of between 1 E 14 cm^{-3} and 5 E 15 cm^{-3}.

15. The semiconductor component as claimed in claim 14,
wherein
the doping concentration lies between 1 E 14 cm^{-3} and 2 E 15 cm^{-3}.

16. The semiconductor component as claimed in one of claims 1, 2 and 5 to 15,
wherein
it is embodied as a diode, IGBT, thyristor or MOSFET.

17. The semiconductor component as claimed in claim 16,
wherein
in the semiconductor body (1) compensation regions (10) of the second conduction type are additionally provided in the voltage taking-up region (5).

18. The semiconductor component as claimed in one of claims 1 to 17,
wherein
a steady-state field stopping area (11) is additionally provided.

19. The semiconductor component as claimed in one of claims 1 to 18,
wherein
at least one further temporarily effective area (9') is provided in addition to the temporarily effective area (9).

20. The semiconductor component as claimed in claim 19,
wherein
the temporarily effective areas (9, 9') are produced by multiple implantations.

21. The semiconductor component as claimed in one of claims 1 to 20,
wherein
it is structured vertically.

22. The semiconductor component as claimed in one of claims 1 to 20,
wherein
it is structured laterally.

23. A method for production of the semiconductor component as claimed in one of claims 1 to 22,

wherein
K centers are introduced by implantation of high-energy particles into a weakly doped region (5) of a semiconductor body (1).

24. The method as claimed in claim 23,
wherein
the K centers (Z) are additionally produced by annealing at a temperature of more than 300°C subsequent to the irradiation.

25. The method as claimed in claim 23 or 24,
wherein
protons or helium nuclei are provided as the high-energy particles.

26. The method as claimed in claim 23 or 24.
wherein
carbon atoms which form K centers and contribute to the material of the semiconductor body (1) are provided as the high-energy particles.

27. The method as claimed in claim 24,
wherein
the annealing is performed at a temperature of more than 420°C.

28. The method as claimed in one of claims 23 to 27,
wherein
a multiple implantation is carried out for producing the temporarily effective area (9).

29. The method as claimed in one of claims 23 to 28,
wherein
the implantation is carried out through a metal foil.

30. The method as claimed in one of claims 23 to 29,
wherein

an implantation with protons for producing a steady-state field stopping area (11) is additionally carried out.

31. The method as claimed in one of claims 23 to 30, wherein
the implantation is performed from the rear side of the semiconductor body, that is to say from the opposite side to the pn junction (4).